

APPENDIX 1

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33. A method for designing, deploying, optimizing or maintaining a communications network or communications networks, comprising the steps of:

providing

(A) a computerized model which represents a physical environment in which a communications network is or will be installed, said computerized model providing a display of at least a portion of said physical environment,

(B) performance attributes for a plurality of system components which may be used in said physical environment, and

one or more of

(C) one or more prediction models which use the computerized model and the performance attributes of specific components of said plurality of components to predict performance characteristics of said communications network,

(D) actual performance measurements taken from said physical environment at one or more locations during one or more measurement runs, and

(E) cost data associated with the installation, procurement, and maintenance of said communications network;

selecting specific components from said plurality of system components for use in said communications network; and

displaying a computer representation of said physical environment using said computerized model, said computer representation showing locations of specific components selected in said selecting step within said physical

environment and performance information for one or more locations within said physical environment, said performance information being any one or more of the following:

(A) presented at said one or more locations in the form of one or more icons,

(B) showing a comparison of actual performance measurements to predicted performance values,

(C) showing a comparison of actual performance measurements taken during two or more measurement runs, and

(D) showing a comparison of at least two different predictions made with at least two different simulations.

34. The method of claim 33 wherein said computer representation is presented in three dimensions in said displaying step.

35. The method of claim 33 wherein said one or more icons are presented in three dimensions in said displaying step.

36. The method of claim 33 wherein a comparison as specified in (B), (C) or (D) in said displaying step is displayed as one more icons on a computer display in said displaying step.

37. The method of claim 36 wherein said one or more icons showing said comparison are presented at said one or more locations in said computer

representation of said physical environment.

38. The method of claim 33 wherein said one or more icons showing said comparison have the functionality of one or more watch points.

39. The method of claim 33 wherein said one or more icons showing said comparison have the functionality of a grid of watch points.

40. The method of claim 33 wherein said comparison shows the effects on performance for the communications network which are attributable to using any of the same or different; frequencies, spectrum bands, operational modes, physical environments, communication network designs, network components, data transmission rates, packet sizes, modulation techniques, power levels, psuedonoise code sequencing, psuedonoise code chip timing, optical frequency bands, network protocols, bandwidths, multiple-access techniques, antenna distribution systems, antenna systems, wiring architectures, cabling methods or system distribution methods, physical interconnections of system components, source or error coding methods, traffic loading conditions, user densities, propagation models, or network configurations.

41. The method of claim 33 where said one or more icons has an attribute selected from the group consisting of height, radius, brightness, hue, saturation, line type and width, transparency, and surface texture, wherein one or more of said attribute varies depending on the performance data.

42. The method of claim 41 wherein said one or more icons is depicted as a graphical cylinder.

43. The method of claim 33 wherein said plurality of system components are selected from the group consisting of base stations, transceivers, cabling, connectors, splitters, amplifiers, antennas, transmitters, RF distribution lines, base station controllers, switches, optical-to-RF couplers, wireless access points, translators, converters, wireless or infrared or wired infrastructure, optical or RF or baseband network components, firewalls, measurement devices, attenuators, repeaters, couplers, connection boxes, splicers, routers, hubs, transducers, and other hardware components.

44. The method of claim 33 wherein said performance information is selected from the group consisting of signal-to-interference ratio (SIR), signal-to-noise ratio (SNR), radio signal strength (RSSI), carrier-to-noise ration (CNR), noise, interference, RMS delay spread, distortion, coverage regions, acceptable service regions, bit or frame error rate, network throughput, latency, packet error rate, quality of service, regions of acceptable quality of service, carried traffic, radio frequency performance values, chip energy to interference ratio, carrier-to-interference ratio, attenuation, radio wave propagation effects, and other wireless communication or other network performance metrics.

45. The method of claim 33 wherein said step of displaying is done in absolute or relative values or in absolute or relative difference values.

46. The method of claim 33 further comprising the step of obtaining said actual performance measurements from measurements obtained by one or more of the measurement device group consisting of: one or more mobile receivers, one or more fixed receivers, one or more remote measurement devices; one or more autonomous measurement devices; one or more hand held measurement devices; one or more sensors; one or more sensor networks; one or more embedded receivers; measurement devices for wireless baseband, RF, or optical networks; measurement devices for wired baseband, RF or optical networks; or manual data entry.

47. The method of claim 46 wherein said actual performance measurements are obtained in parallel or serially from a plurality or combination of one or more receivers from said measurement device group.

48. The method of claim 33 wherein said step of displaying can be performed at either a client or server.

49. The method of claim 33 wherein said displaying step allows visualizing from any angle, orientation, distance or perspective.

50. The method of claim 33 wherein measurement values, predicted values, differences between measurement values, differences between predicted values, or differences between measured and predicted values are all locally averaged.

51. The method of claim 33 wherein measurement values, predicted values, differences between measurement values, differences between predicted values, or differences between measured and predicted values are displayed as an overlay on said computerized model which models at least a portion of the physical environment and its associated network components.

52. A computerized system for designing, deploying or optimizing a communications network or communications networks comprising:

a computer including

(A) a computerized model which represents a physical environment in which a communications network is or will be installed, said computerized model providing a display of at least a portion of said physical environment,

(B) performance attributes for a plurality of system components which may be used in said physical environment, and

one or more of:

(C) one or more prediction models which use the computerized model and the performance attributes of specific components of said plurality of components to predict performance characteristics of said communications network, and

(D) actual performance measurements taken from said physical environment at one or more locations during one or more measurement runs, and

(E) cost data associated with the installation, procurement, and maintenance of said communications network;

a selector for selecting specific components from said plurality of system components for use in said communications network; and

a display for displaying a computer representation of said physical environment using said computerized model, said computer representation showing locations of specific components selected in said selecting step within said physical environment and performance information for one or more locations within said physical environment, said performance information being any one or more of the following:

(A) presented at said one or more locations in the form of one or more icons,

(B) showing a comparison of actual performance measurements to predicted performance values,

(C) showing a comparison of actual performance measurements taken during two or more measurement runs, and

(D) showing a comparison of at least two difference predictions made with at least two different simulations.

53. The computerized system of claim 52 wherein said computer representation is presented in three dimensions in said displaying step.

54. The computerized system of claim 52 wherein said one or more icons are presented in three dimensions in said display.

55. The computerized system of claim 52 wherein a comparison presented on said display as specified in (B), (C), or (D) is displayed as one more icons.

56. The computerized system of claim 55 wherein said one or more icons showing said comparison are presented at said one or more locations in said computer representation of said physical environment.

57. The computerized system of claim 52 wherein said one or more icons showing said comparison have the functionality of one or more watch points.

58. The computerized system of claim 52 wherein said one or more icons showing said comparison have the functionality of a grid of watch points.

59. The computerized system of claim 52 wherein said comparison shows the effects on performance for the communications network which are attributable to using any of the same or different; frequencies, spectrum bands, operational modes, physical environments, communication network designs, network components, data transmission rates, packet sizes, modulation techniques, power levels, psuedonoise code sequencing, psuedonoise code chip timing, optical frequency bands network protocols, bandwidths, multiple-access techniques, antenna distribution systems, antenna systems, wiring architectures, cabling methods or system distribution methods, physical interconnections of system components, source or error coding methods, traffic loading conditions, user densities, propagation models, or network configurations.

60. The computerized system of claim 52 wherein said one or more icons has an attribute selected from the group consisting of height, radius, brightness, hue, saturation, line type and width, transparency, and surface texture, wherein one or more of said attribute varies depending on the performance data.

61. The computerized system of claim 60 wherein said one or more icons is depicted as a graphical cylinder.

62. The computerized system of claim 52 wherein said plurality of system components are selected from the group consisting of base stations, transceivers, cabling, connectors, splitters, amplifiers, antennas, transmitters, RF distribution lines, base station controllers, switches, optical-to-RF couplers, wireless access points, translators, converters, wireless or infrared or wired infrastructure, optical or RF or baseband network components, firewalls, measurement devices, attenuators, repeaters, couplers, connection boxes, splicers, routers, hubs, transducers, and other hardware components.

63. The computerized system of claim 52 wherein said performance information is selected from the group consisting of signal-to-interference ratio (SIR), signal-to-noise ratio (SNR), radio signal strength (RSSI), carrier-to-noise ratio (CNR), noise, interference, RMS delay spread, distortion, coverage regions, acceptable service regions, bit or frame error rate, network throughput, latency, packet error rate, quality of service, regions of acceptable quality of service, carried traffic, radio frequency performance values, chip energy to interference ratio, carrier-to-

interference ratio, attenuation, radio wave propagation effects, and other wireless communication or other network performance metrics.

64. The computerized system of claim 52 wherein said display provides absolute or relative values or absolute or relative difference values.

65. The computerized system of claim 52 further comprising a means for obtaining said actual performance measurements.

66. The computerized system of claim 65 wherein said means for obtaining said actual performance measurements are provided by one or more of the measurement device group consisting of one or more mobile receivers, one or more fixed receivers, one or more remote measurement devices; one or more autonomous measurement devices; one or more hand held measurement devices; one or more sensors; one or more sensor networks; one or more embedded receivers; measurement devices for wireless baseband, RF, or optical networks; measurement devices or wired baseband, RF, or optical networks; or manual data entry.

67. The computerized system of claim 66 wherein said actual performance measurements are obtained in parallel or serially from a plurality or combination of one or more receivers from said measurement device group.

68. The computerized system of claim 52 wherein said display is located at either

or both a client or server.

69. The computerized system of claim 52 wherein said display can be adjusted for visualization from any angle, orientation, distance, or perspective.

70. The computerized system of claim 52 wherein said measurement values, predicted values, differences between measurement values, differences between predicted values, or differences between measured and predicted values are all locally averaged.

71. The computerized system of claim 52 wherein measurement values, predicted values, differences between measurement values, differences between predicted values, or differences between measured and predicted values are displayed as an overlay on said computerized model which models at least a portion of the physical environment and its associated network components.

72. The computerized system of claim 52 wherein said performance information of (B), (C), or (D) is displayed by said display by using one or more of text, color, grid size, grid color, contour line, grid height, mesh color, mesh size, and bar graph display.

73. The method of claim 33 wherein said displaying step displays performance information of (B), (C), or (D) by using one or more of text, color, grid size, grid color, contour line, grid height, mesh color, mesh size, and bar graph display.